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Review: Short-term sea-level changes in a greenhouse world — A view from the Cretaceous

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ABSTRACT

This review provides a synopsis of ongoing research and our understanding of the fundamentals of sea-level change today and in the geologic record, especially as illustrated by conditions and processes during the Cretaceous greenhouse climate episode. We give an overview of the state of the art of our understanding on eustatic (global) versus relative (regional) sea level, as well as long-term versus short-term fluctuations and their drivers. In the context of the focus of UNESCO-IUGS/IGCP project 609 on Cretaceous eustatic, short-term sea-level and climate changes, we evaluate the possible evidence for glacio-eustasy versus alternative or additional mechanisms for continental water storage and release for the Cretaceous greenhouse and hothouse phases during which the presence of larger continental ice shields is considered unlikely. Increasing evidence in the literature suggests a correlation between long-period orbital cycles and depositional cycles that reflect sea-level fluctuations, implying a globally synchronized forcing of (eustatic) sea level. Fourth-order depositional sequences seem to be related to a ~405 ka periodicity, which most likely represents long-period orbital eccentricity control on sea level and depositional cycles. Third-order cyclicity, expressed as time-synchronous sea level falls of ~20 to 110 m on ~0.5 to 3.0 Ma timescales in the Cretaceous, are increasingly recognized as connected to climate cycles triggered by long-term astronomical cycles that have periodicity ranging from ~1.0 to 2.4 Ma. Future perspectives of research on greenhouse sea-level changes comprise a high-precision time-scale for sequence stratigraphy and eustatic sea-level changes and high-resolution marine to non-marine stratigraphic correlation.

Contents

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